L.1 (4.1) Increasing & Decreasing Functions

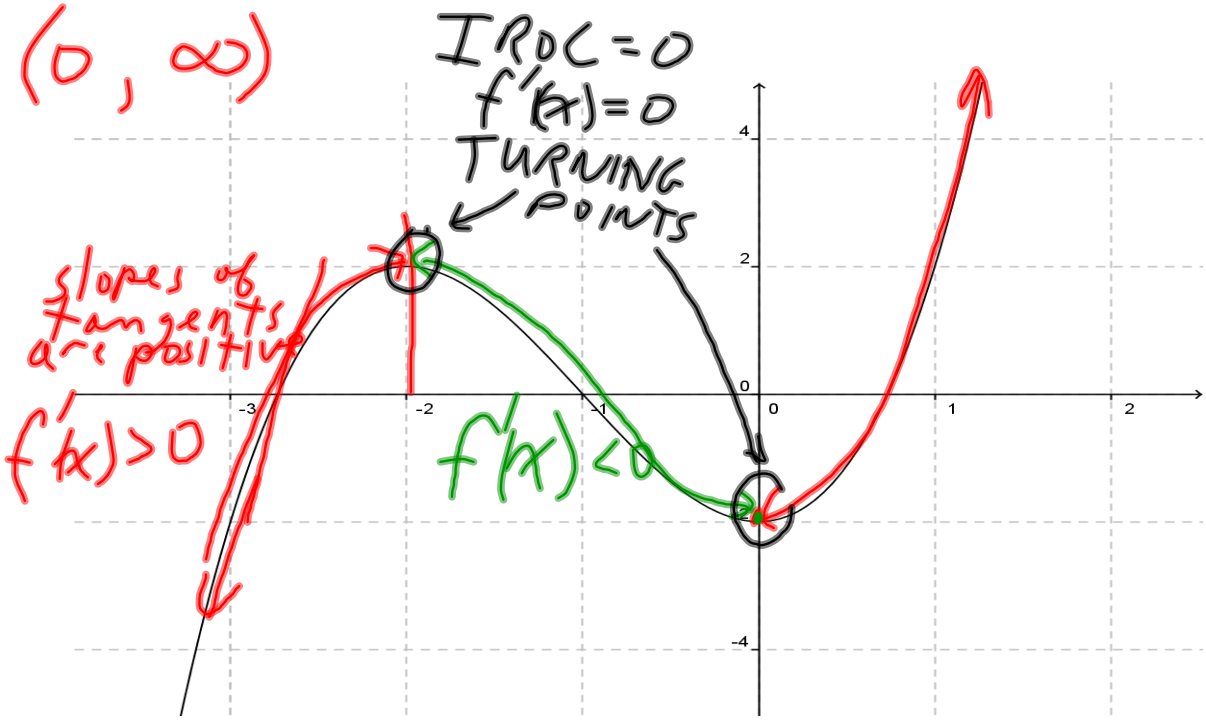
On what intervals is the function increasing?

$(-\infty, -2)$

$(0, \infty)$

On what intervals is the function decreasing?

$(-2, 0)$



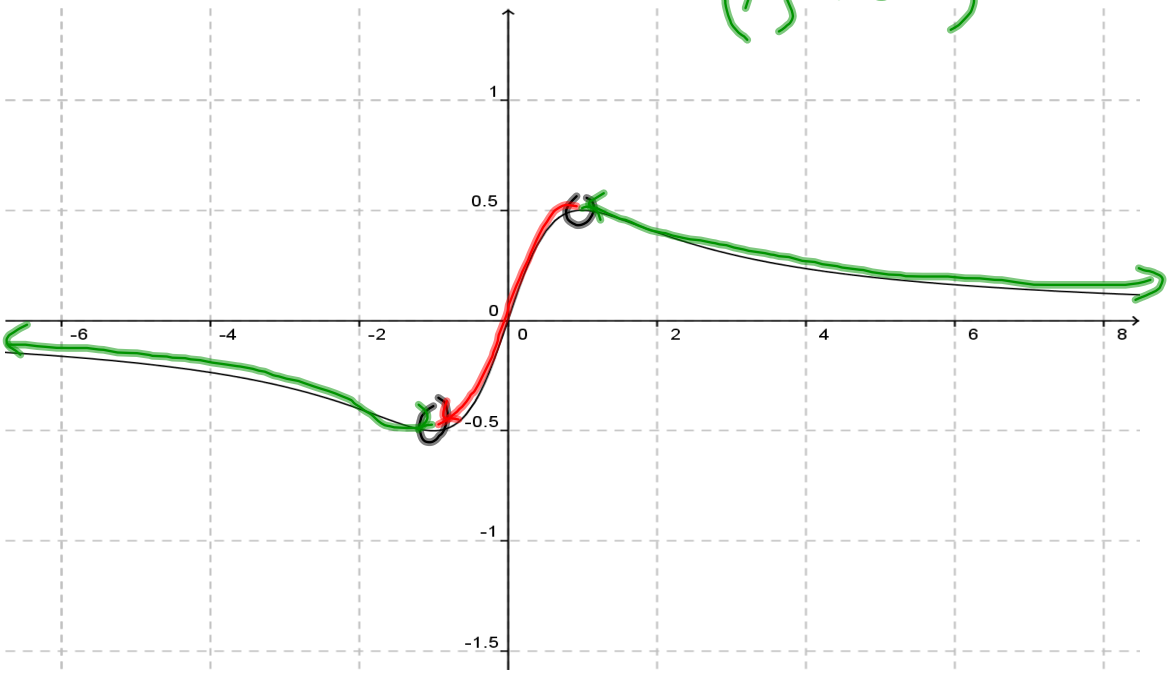
On what intervals is the function increasing?

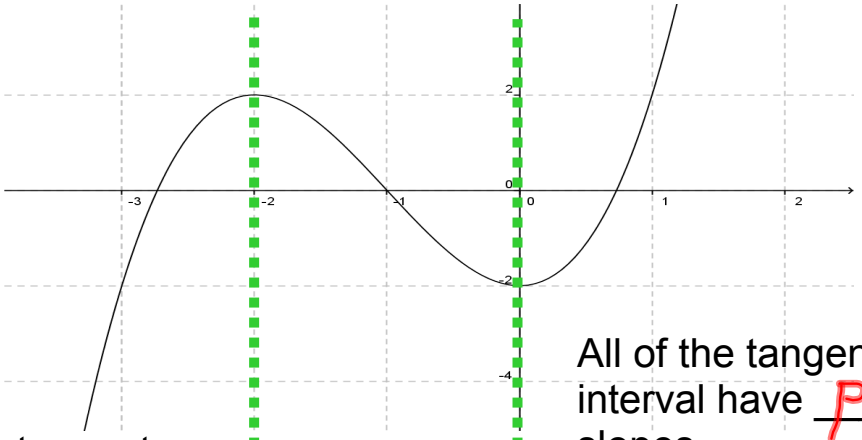
$(-1, 1)$

On what intervals is the function decreasing?

$(-\infty, -1)$

$(1, +\infty)$





All of the tangent lines in this interval have positive slopes.

All of the tangent lines in this interval have negative slopes.

All of the tangent lines in this interval have positive slopes.

Using the derivative to reason about intervals of increase & decrease of a function, we can conclude:

- A function, f(x), is increasing on the interval (a, b) if $f'(x) > 0$.
- A function, f(x), is decreasing on the interval (a, b) if $f'(x) < 0$.

Ex1: Find the intervals of increase and decrease of the function $f(x) = 3x^4 + 4x^3 - 12x^2$.

find $f'(x)$
factor $f'(x)$
create interval table
determine where $f'(x) > 0$ INCREASE or $f'(x) < 0$ DECREASE

find $f'(x)$

$f(x) = 3x^4 + 4x^3 - 12x^2$

$f'(x) = 12x^3 + 12x^2 - 24x$

factor $f'(x)$

$f'(x) = 12x(x^2 + x - 2)$

$= 12x(x+2)(x-1)$

$f'(x) = 0$ at $x = -2, 0, +1$

Make interval table

	$x<-2$	$-2<x<0$	$0<x<1$	$1<x$
12	+	+	+	+
$x+2$	−	+	+	+
x	−	−	+	+
$x-1$	−	−	−	+
$f'(x)$	−	+	−	+

From the table
INTERVALS OF INCREASE ARE $(-2, 0)$ OR $(1, \infty)$

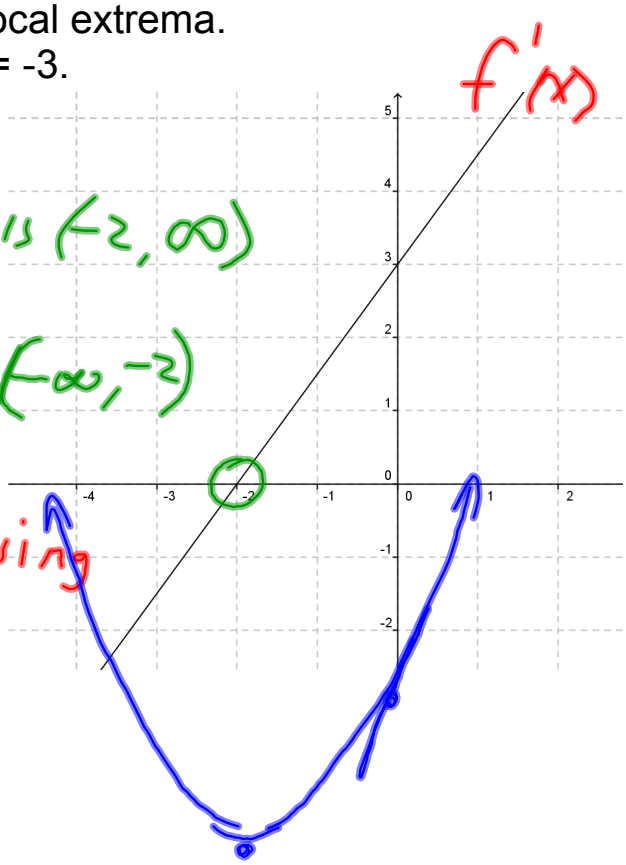
INTERVALS OF DECREASE ARE $(-\infty, -2)$ OR $(0, 1)$

Ex2: Given the graph of f'(x),

a) find the intervals of increase and decrease of f(x).

b) find the x-value(s) of the local extrema.

c) sketch f(x) assuming f(0) = -3.



a) $f'(x) > 0$ for $x > -2$

$\therefore$ INTERVAL OF INCREASE IS $(-2, \infty)$

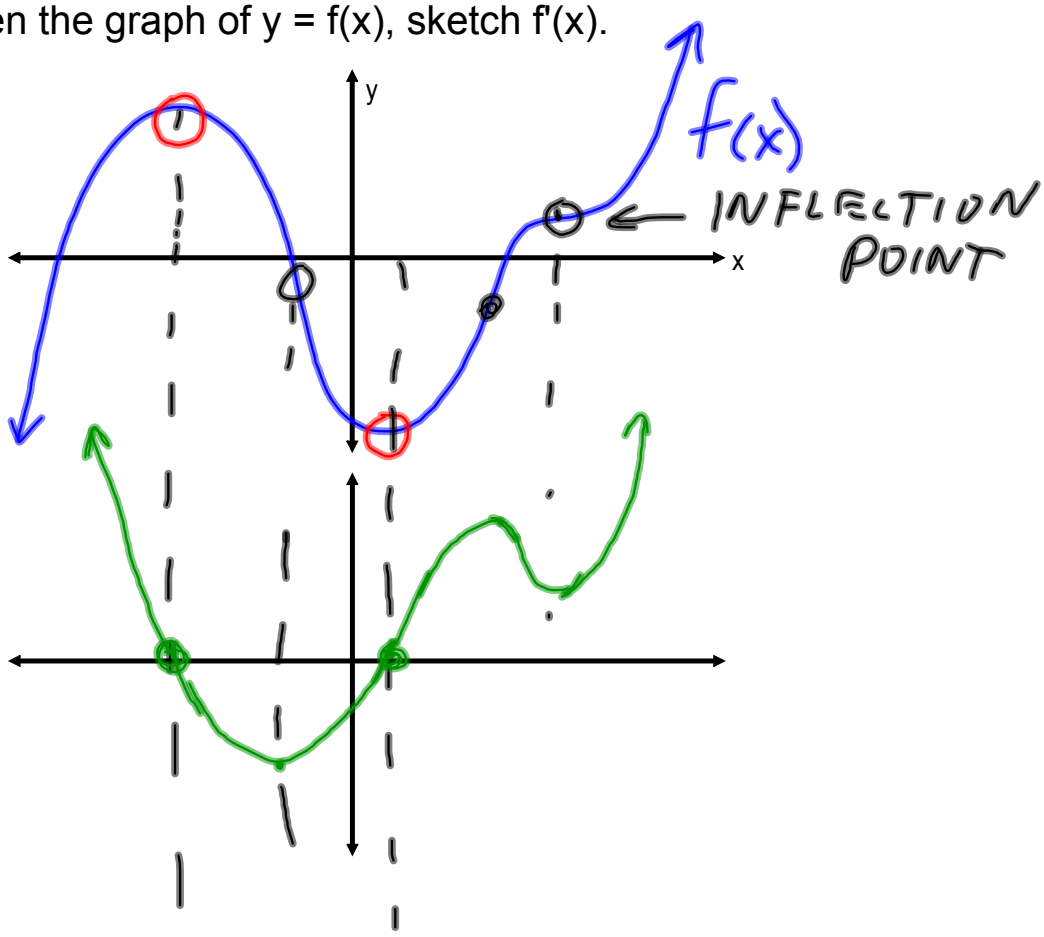
$f'(x) < 0$ for $x < -2$

INTERVAL OF DECREASE IS $(-\infty, -2)$

b) $f(x)$ goes from decreasing to increasing at $x = -2$

$\therefore$ there is a minimum at $x = -2$

Ex3: Given the graph of y = f(x), sketch f'(x).



Assigned Work:

p.169-171

#1ab, 3, 4abcd(algebraically), 8, 9, 10

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Work Sheet